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I-Slotted Rectangular Microstrip Patch Antenna Design and Analysis for Wireless Applications

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Abstract*: This research demonstrates a new compact I-slotted patch antenna solution and evaluates the fundamental antenna characteristics. The antenna is fed through the inserted feed technique. The proposed patch antenna gets its 3D modelling and design from the IE3D simulation software package. The main purpose of this proposed research is to develop a small antenna with high bandwidth capacity. The bandwidth capability of the suggested microstrip antenna extends from 3.721 GHz to 5.423 GHz. Through basic inset feeding and I-slotted broad bandwidth addition the antenna design resulted in 5 dB gain with 88% radiation efficiency.*

Keywords*: I-shaped, compact patch, antenna (RMPA), inset feed, rectangular microstrip patch, wideband*
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I. Introduction

Modern wireless systems focus on antenna design improvement because it functions as the most critical element of communication systems therefore enabling progress in communication technology. Human communication began through the use of sound expressions in speech activities. The part of electromagnetic spectrum that is visible produced signals for these optical communication systems. Radio communication through the electromagnetic spectrum began to emerge in human history only during the recent period while most human interaction previously happened through visible light spectrum channels[7]. Antennas serve as essential instruments for human access to electromagnetic spectrum which stands as the biggest natural resource available to mankind. These features enable microstrip patch antennas to become popular choices for wireless applications since they provide low profile functionality along with high transmission efficiency and light weight characteristics together with conformal and planar structure as well as compactness at low cost and easy integration with microwave circuits [1].

Modern research presents additional scrutiny to compact microstrip antennas because of rising market demand for diminutive antenna systems both for personal and commercial sectors. Increasing substrate dielectric constant becomes essential for making small microstrip antennas at a particular operating frequency [2-4]. A glass epoxy base construction provides the suggested antenna with 69.46% bandwidth and makes it possible to achieve above 88% radiation efficiency.

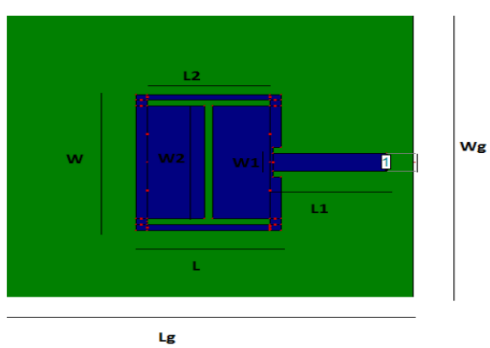

Fig 1: Geometry of proposed microstrip antenna

II. Results and Discussions

The return loss evaluation of the proposed microstrip antenna can be found in Figure 2. Through the proposed antenna design researchers have obtained a wide bandwidth of 49.46% width. Such broad operating band characteristics match perfectly with this design. The retrieved 3D radiation pattern shown in Figure 4 comes from IE3D software whereas Figure 3 shows the Smith chart. The plot of Figure 5 depicts how gain measured in 5dBi behaves throughout the frequency range[7]. The performance graphs of efficiency against frequency and directivity against frequency for the proposed microstrip antenna appear in Figures 6 and 7. The designed microstrip antenna reaches a higher gain point while achieving about 88% radiation efficiency.

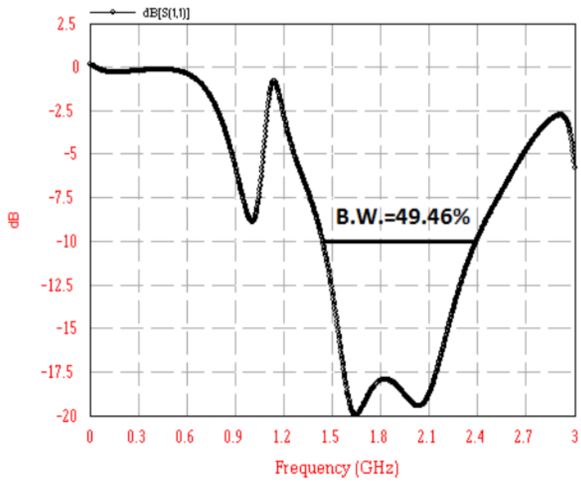

Fig 2: Return loss Vs frequency of proposed microstrip antenna

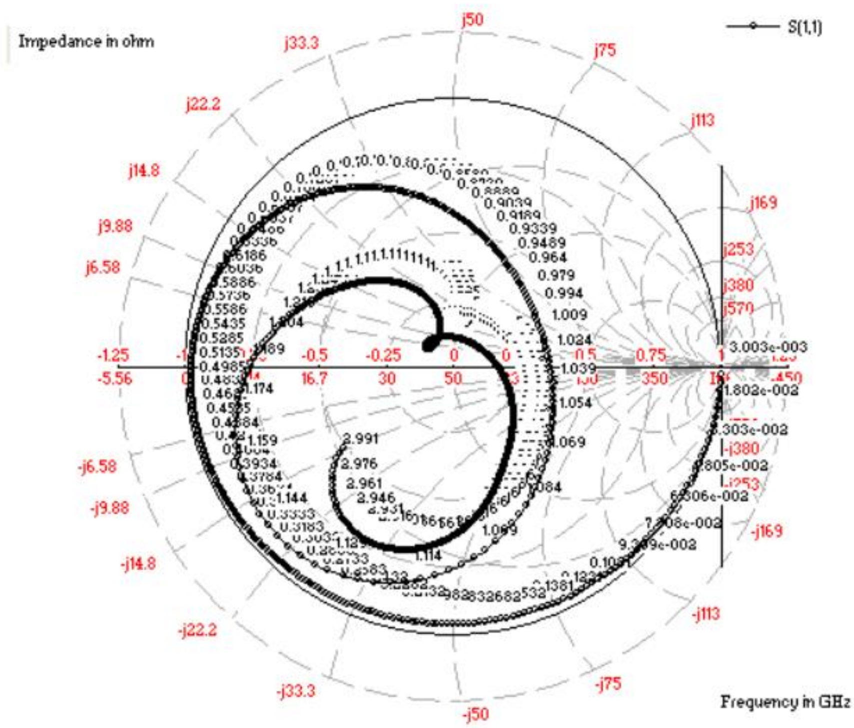

Fig 3: Smith chart plot of proposed microstrip antenna

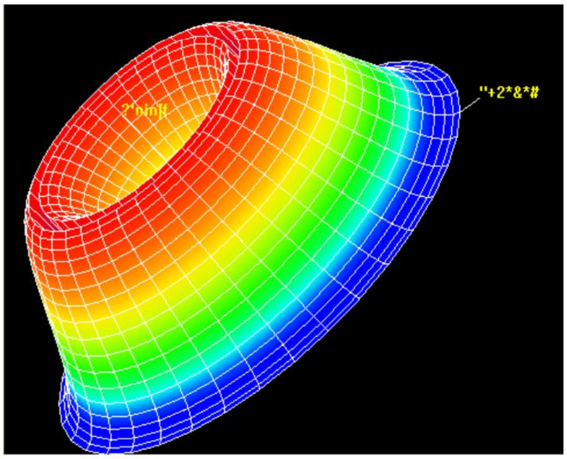

Fig 4: 3D radiation pattern of proposed microstrip antenna

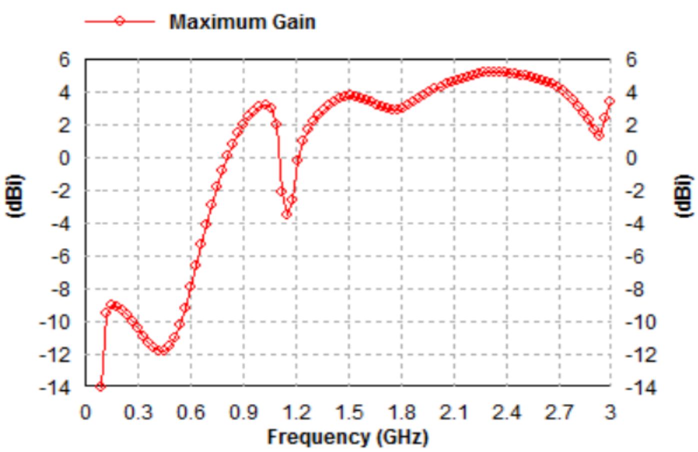

Fig 5: Gain Vs frequency of proposed microstrip antenna

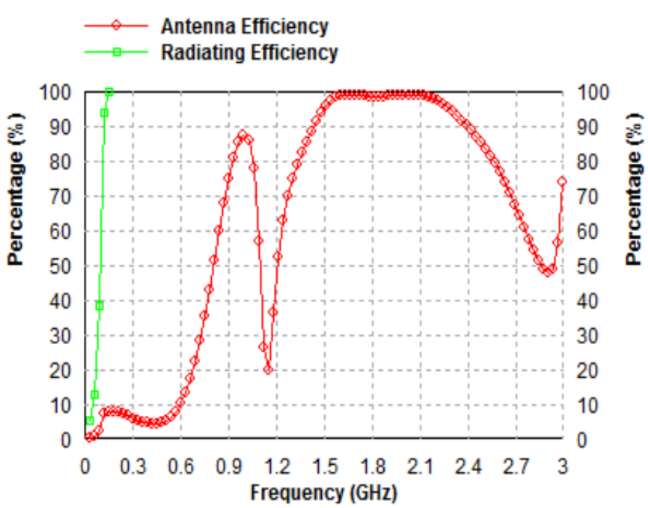

Fig 6: Efficiency Vs frequency of proposed microstrip antenna

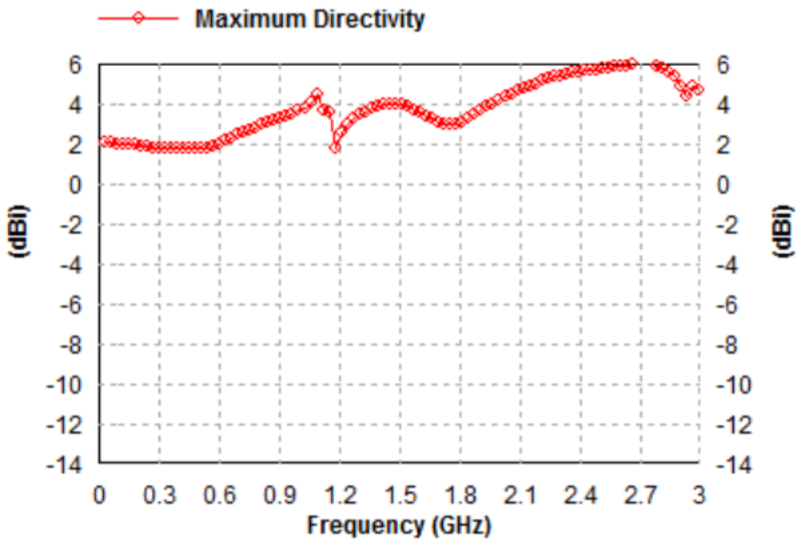

Fig 7: Directivity Vs frequency of proposed microstrip antenna

III. Conclusion

The research analyses a wide band I-slotted inset line feed microstrip antenna through simulation. The antenna works below 4 GHz frequency band and uses glass epoxy materials with a dielectric constant of 4.4 for its design to achieve a wide bandwidth of 69.46%[7]. The designed antenna operates in the 2.444-4.393 GHz WLAN frequency range according to specifications for compact patch antenna characteristics. The proposed microstrip antenna achieves high radiation performance with efficiency reaching 88% while gaining up to 5 dB.

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